accordingly proposed the following as the formula of the normal or functional dentition of the Walrus:—

$$i\,\frac{1-1}{1-1},\ c\,\frac{1-1}{0-0},\ p\,\frac{3-3}{3-3}=18.$$

But, as might be expected in a dentition deviating so remarkably from that of other Mammals of the same order, varieties are not unfrequently met with in the number of the teeth of the Walrus. Professor Owen cited instances of such varieties in ten skulls of the Walrus, of different ages and sex. The result of which was, that occasionally a small tooth was found anterior to the normal series of four, and more commonly in the upper than in the lower jaw; and that, more rarely, a small tooth was superadded behind the normal four, in the upper jaw, and still more rarely in the lower jaw: the formula of the dentition of such varieties, in excess, being,—

$$i\,\frac{2-2}{2-2},\ c\,\frac{1-1}{0-0},\ p\,\frac{3-3}{3-3},\ m\,\frac{1-1}{1-1}=26.$$

The additional anterior small incisor was due either to the retention and growth of the first deciduous denticle, or to the development of a small successor to it. The additional posterior grinder was due to the occasional development of a germ in the back part of the gum or jaw. The minute milk-teeth relate, by their gubernacula, to the development of the permanent teeth, but seem never to be put to use themselves; the milk-canine was buried in the gum outside the protruded point of the permanent canine; so that this tooth is extricated and cuts the gum before the tooth of which it is the successor makes its appearance, that tooth being probably removed by absorption. Here, therefore, was another instance, analogous to that of the rudimental teeth in the fœtal Whale, of parts developed without any obvious office as organs of mastication, but serving to illustrate the relation of adhesion to a more normal type of dentition. In conclusion, Professor Owen remarked that the food of the Walrus consisted, in a state of nature, of sea-weed, crustaceans and mollusks; and that although, by the totality of its organization, it must be placed near the Seals, and with them be classed in the order *Carnivora*, yet that the incisors and premolars were alike well adapted to pound marine plants, and to break and crush shells. Fragments of a bivalve shell, a species of *Mya*, had been found with pounded sea-weed, by the Surgeon of Parry's Polar Expedition, in the stomach of a full-grown Walrus. The great descending canine tusks serve as weapons of offence and defence, and to aid the animal in mounting and clambering over ice-blocks, bergs and floes in the Arctic Seas, in which the Walrus has been organized to enjoy its existence.

ROYAL SOCIETY.

November 23, 1854.—Thomas Bell, Esq., V.P., in the Chair.

"On the Impregnation of the Ovum in the Stickleback." By W. H. Ransom, M.D.

I purpose placing before the Royal Society in this communication, the principal results of experiments made during the months of June and July last, on the impregnation of the ovum in *Gasterosteus leiurus* and *G. pungitius*, and hope to be able to furnish a more detailed account of my observations on a future occasion.

The ovarian ovum of these fishes, at a very early stage of its development, is provided with a proper investing membrane, the future chorion. At a later period, one portion of this membrane presents a number of cup-shaped pediculated bodies scattered over its surface, and in the centre of this part of the chorion there is a funnel-shaped depression, pierced by a canal which leads towards the centre of the egg.

In the nearly ripe ovum, the germinal vesicle occupies an excentric position with respect to the egg as a whole, but imbedded in the centre of a semi-solid accumulation of fine granular matter at that part of the surface which corresponds to the funnel-shaped depression; so that the apex of the funnel, projecting inwards beyond the level of the inner surface of the chorion, makes a depression in the centre of the layer of granular matter, and comes nearly into contact with the germinal vesicle.

For convenience of description, the funnel-shaped depression will now be called *micropyle*, and the layer of granular matter before impregnation, *discus proligerus*.

The germinal vesicle disappears before the ovum leaves the ovary, and no remnant of it or its spots can be seen.

A very delicate membrane invests the yelk within the chorion; this membrane is more distinct after impregnation, or after the action of water upon an unimpregnated egg; it may be isolated, and then exhibits a remarkable degree of elasticity. It is not a *yelk-membrane*, and it will be spoken of as the *inner membrane*.

The layer of the yelk immediately internal to the inner membrane passing over the discus proligerus, is formed by yellowish highly refractive drops which disappear in water, undergoing some remarkable changes, and by a fluid substance which water precipitates in a finely granular form.

The principal mass of the yelk consists of a clear and very consistent albumen. The oil is collected into a few very large drops which come up to the surface.

When the ovum escapes from the ovary, it enters a cavity which may be considered as the ovarian extremity of the oviduct, in which a considerable quantity of clear viscid fluid is previously secreted and collected, to be expelled with the ova.

More exact observation of the micropyle in the free eggs proves that the inner end of the canal is either open, or at most closed by a very delicate membrane. When looking into the funnel from the wide mouth, the apex being in focus, a bright, clear, round or oval spot, such as an aperture would produce, is always visible. If a section be made of the egg, and the apex brought into focus from within, the same clear spot is well seen, and the fine and regularly dotted structure of the chorion is seen to cease suddenly at the margin of the clear spot.

The general form of the egg after deposition is round, but it is rendered irregular by indentations caused by the pressure of other eggs. It is inelastic, and retains impressions made in it by a needle; and when placed in water, these characters remain for a long time if it be not impregnated,—a fact which indicates that water does not pass through the micropyle, or by imbibition through the chorion. The viscid secretion of the oviduct which invests the eggs may defend them against the action of water, in which it does not readily diffuse or dissolve. This secretion has an alkaline reaction. The substance of the yelk has a decidedly acid reaction,—more than enough to neutralize the alkalinity of the viscid secretion. This reaction is, I believe, due to a peculiar organic acid, but the experiments relating to this question are not yet complete. The seminal particles of the male continue to move for a considerable period in the viscid secretion which envelopes the ripe ova, but they very quickly become still in water.

In the act of impregnation one or more (as many as four have been seen) spermatozoids pass into the micropyle, and probably by their proper motion overcome the obstruction which prevents the entrance of water. Actively moving spermatozoids may remain in contact with the chorion for eighteen minutes at least without producing any sensible change in the ovum, provided none of them enter the micropyle, but when one is seen to enter, in about a quarter of a minute a change is observable.

The changes which are observed to follow the entrance of the spermatozoids into the micropyle are the following:—In about a quarter of a minute the tube is shortened, and very soon a clear space becomes visible within the chorion near the micropyle: this space, or respiratory chamber, gradually extends to the opposite pole of the egg and increases in diameter, as does also the whole ovum. During the formation of this space the surrounding fluid enters through the micropyle, and this gradually retracts and is at length closed. This entrance of fluid into the egg effaces the depressions, restores the round form, and makes it firm and elastic; but does not cause any such precipitation of granular matter as is produced by its artificial introduction.

While the respiratory chamber is yet in progress of formation, the yellow drops of the superficial layer of the yelk grow pale and disappear; the change beginning near the micropyle. As a result of this, the whole egg becomes clearer, and the *discus proligerus*, which may be now more correctly denominated the *germinal mass*, is more distinct.

The yelk now very slowly alters its form, one surface becoming flattened; but about fifteen or twenty minutes after impregnation a remarkable and more vivid contraction begins, causing the yelk to pass through a series of regularly recurring forms. The contraction begins on one side near the equator, and soon forms a circular constriction which gives the yelk the figure of a dumb-bell, the longer axis of which is the polar axis of the egg. The constriction travels towards the germinal pole, and next produces a flask-shaped figure;

this is at length lost by the constriction passing on, and the round form is regained in about a minute. This wave reappears and travels forward again without any distinct period of rest, and I have seen these movements continue for forty-five minutes, though towards the latter part of this period they are less distinct and more limited in extent. The germinal mass has itself during these contractions, which strongly resemble the peristaltic movements of the intestine, undergone changes in form, and has increased in bulk and distinctness. These movements are unaffected by weak galvanic currents.

During the passage forward of each wave of contraction there is an oscillation of the whole mass of the yelk, so that its germinal pole passes once to the right and once to the left of the micropyle, to which it at first corresponded. The plane of this oscillation may be vertical, horizontal, or inclined, but always cuts the micropyle; it begins and ceases with the contractions already mentioned, and would seem to be a mechanical result of them.

For some time before cleavage begins, the only changes of form are the appearance of wave-like elevations and depressions along the under surface of the germinal mass, and its alternate concentration and diffusion. Cleavage begins in about two hours after impregnation; no embryonic cell was observed before it began, nor in any of the cleavage masses.

The inner membrane is folded in during cleavage; it is easily seen thrown into folds at the cleft, and for this reason I do not consider it a *yelk-membrane*, which term would be better applied to the chorion.

December 21, 1854.—The Lord Wrottesley, President, in the Chair.

"Remarks on the Anatomy of the *Macgillivrayia pelagica* and *Cheletropis Huxleyi* (Forbes); suggesting the establishment of a new genus of Gasteropoda." By John D. Macdonald, R.N., Assistant-Surgeon H.M.S. Herald.

Having examined the anatomy of the *Macgillivrayia pelagica* and several smaller species of pelagic Gasteropoda, not exhibiting the least similarity in the character of their shells, the author found that they all presented a very close relationship to each other in the type of their respiratory organs, and in other points of structure of less importance.

The gills in every instance seemed to be fixed to the body of the animal immediately behind the head, and did not appear to be appended to the mantle, as in the Pectinibranchiata properly so called. They were also invariably four in number, and arranged in a cruciform manner round a central point. They were free in the rest of their extent, elongated and flattened in form, with a pointed extremity, and fringed with long flowing cilia, set in a frilled border. They were, moreover, furnished with muscular fibres, both transverse and longitudinal, and exhibited great mobility when protruded, but lay side by side in the last whorl of the shell when retracted.

The auditory capsules, each containing a spherical otolithe, were closely applied to the inner and posterior part of the larger or anterior ganglion of the subœsophageal mass.

There were two tentacula, each bearing at the outer side of its base an eye consisting of a globular lens with optic nerve and retinal expansion. The foot was large and very mobile, but a vesicular float has been observed only in *Macgillivrayia*.

The respiratory siphon was either a simple fold of the mantle forming a temporary tube (*Cheletropis*), or a fold whose borders were united through their whole length, leaving an aperture at the end, as in *Macgillivrayia*.

A lingual ribbon with well-marked rachis and pleuræ occurs in all the species. Very perfect labial plates with closely-set dental points arm the mouth in some instances, and probably in all.

The little animals possessing in common the characters here described, nevertheless fabricate shells so very different as to admit of their division into well-marked genera.

The author conceives that the obvious difference between the pectinibranchiate type of respiratory organs and that observed in the group of Gasteropoda now under consideration, affords sufficient grounds for placing the latter in a distinct order by themselves; and as illustrations of it he proceeds to give some details of the structure of the two species mentioned in the title of the paper, whose shells have been already described by the late Prof. E. Forbes, and figured in Mr. Macgillivray's 'Narrative of the Voyage of H.M.S. Rattlesnake.'

In *Macgillivrayia* the disc of the foot is broad and connected by a narrow attachment to the body just beneath the neck; it carries an operculum behind, and is cleft by a notch in front. A raphe observable in the median line, as well indeed as the whole character of this part of the organ, seems to shadow forth the transformation of the single foot of the Gasteropod into the wing-like expansion of the Pteropod.

After describing the labial plates and lingual strap, the eyes and the branchiæ, the author observes that the tubular siphon protrudes from the shell on the left side and seems to indicate the coexistence of a respiratory chamber with naked branchiæ.

The vesicular float, like that of *Ianthina*, noticed by Mr. Macgillivray, consists of an aggregation of vesicles varying both in number and size in different cases. It is exceedingly delicate, and could not be found in the specimens first obtained, having probably been destroyed or detached from the foot by the force of the water running through the meshes of the net with which they were captured. Its coexistence with an operculum shows that it is not a modification of the latter.

Of the *Cheletropis Huxleyi*, numerous specimens were found in Bass's Straits and in the South Pacific, between Sydney and Lord Howe's Island.

After giving some details respecting the shell and the foot, the author observes that the latter organ was destitute of float, at least in the specimens he obtained, but was furnished with an operculum, which, probably from its extreme thinness and smallness, had escaped the notice of Professor Forbes. He then points out the peculiarities of the respiratory apparatus.

The portion of the mantle which forms the respiratory siphon, is short, and its opposite edges are merely in apposition, without organic union. The branchiæ are of two kinds, covered and naked. The covered gill is single but of considerable length. It is beautifully pectinated, and fringed with long cilia, and, doubtless, represents the respiratory organ of the pectinibranchiate Gasteropoda. The basis of this part is a long and narrow strip of a tough and fibrous material, folded upon itself into a series of loops invested with a coating of epithelium, and richly ciliated along the free border. The naked gills are four in number, similar both in situation and character to those of *Macgillivrayia*. Each gill is of an oval or elongated form, presenting a thin, frilled and corrugated border, beset with long whip-like cilia. In the central parts muscular fibres are distinctly discernible, some disposed lengthwise and others transversely.

The lingual strap is next described, as well as two file-like triturating plates with which the mouth is furnished.

The two tentacula of each side appear as it were enclosed in one envelope, so as to form a single tactile instrument, which bears a large dark eye on its outer side near the base. To this latter organ the tegumentary covering forms a kind of cornea, beneath which is a spherical lens resting on a mass of black pigment, both being enclosed in a little sac; and the optic nerve, emerging from the sub-œsophageal ganglion, joins the miniature globe and expands into a retina. The author was unable to trace an opening through the pigment for the passage of light, but thinks it probable that, as in the ocelli of insects, such an aperture exists in the central part. The auditory capsules are situated at some distance behind the eyes, and may be distinctly seen with the microscope when the surrounding parts are carefully removed with fine needles. They are of a rounded or oval form, and each contains a beautifully transparent and highly refracting otolithe, much larger than the lens of the eye.

January 11, 1855.—Thomas Bell, Esq., V.P., in the Chair.

"On the Development of Muscular Fibre in Mammalia." By William S. Savory, M.D.

The author's observations were made chiefly upon fœtal pigs, but they have been confirmed by repeated examinations of the embryos of many other animals, and of the human fœtus.

If a portion of tissue immediately beneath the surface from the dorsal region of a fœtal pig, from one to two inches in length, be examined microscopically, there will be seen, besides blood-corpuscles in various stages of development, nucleated cells and free nuclei or cytoblasts scattered through a clear and structureless blastema in great abundance. These cytoblasts vary in shape and size; the smaller ones, which are by far the most numerous, being generally round, and the larger ones more or less oval. Their outline is distinct and well defined, and one or two nucleoli may be seen in their interior as small, bright, highly refracting spots. The rest of their substance is either uniformly nebulous or faintly granular.

The first stage in the development of striated muscular fibre consists in the aggregation and adhesion of the cytoblasts, and their investment by blastema so as to form elongated masses. In these clusters the nuclei have, at first, no regular arrangement. Almost, if not quite as soon as the cytoblasts are thus aggregated, they become invested by the blastema, and this substance at the same time appears to be much condensed, so that many of the nuclei become obscured.

These nuclei, thus aggregated and invested, next assume a much more regular position. They fall into a single row with remarkable uniformity, and the surrounding substance at the same time grows clear and more transparent, and is arranged in the form of two bands bordering the fibre and bounding the extremities of the nuclei, so that now they become distinctly visible. They are oval, and form a single row in the centre of the fibre, closely packed together side by side, their long axes lying transversely, and their extremities bounded on either side by a thin clear pellucid border of apparently homogeneous substance.

It is to be observed how closely the muscular fibres of mammalia at this period of their development resemble their permanent form in many insects.

The fibres next increase in length and the nuclei separate. Small intervals appear between them. The spaces rapidly widen, until at last the nuclei lie at a very considerable distance apart. At the same time the fibre strikingly decreases in diameter; for as the nuclei separate, the lateral bands fall in and ultimately coalesce.

This lengthening of the fibre and consequent separation of the nuclei is due to an increase of material, and not to a stretching of the fibre.

Soon after the nuclei have separated some of them begin to decay. They increase in size; their outline becomes indistinct; a bright border appears immediately within their margin; their contents become decidedly granular; their outline is broken and interrupted; and presently an irregular cluster of granules is all that remains, and these soon disappear.

It sometimes happens that the nuclei perish while in contact, before the fibre elongates; but the subsequent changes are the same.

The striæ generally first become visible at this period, immediately within the margin of the fibre.

The fibre is subsequently increased in size, and its development is continued by means of the surrounding cytoblasts. These attach themselves to its exterior, and then become invested by a layer of the surrounding blastema. Thus, as it were, nodes are formed at intervals on the surface of the fibre. These invested nuclei are at first readily detached, but they soon become intimately connected and indefinitely blended with the exterior of the fibre. All its characters are soon acquired, the nuclei at the same time gradually sink into its substance, and an ill-defined elevation, which soon disappears, is all that remains.

Lastly, the substance of the fibre becomes contracted and condensed. The diameter of a fibre towards, or at the close of intra-uterine life, is considerably less than at a much earlier period.

At the period of birth muscular fibres vary much in size.

The several stages in the development of muscular fibre, above mentioned, do not succeed each other as a simple consecutive series; on the contrary, two, or more, are generally progressing at the same time. Nor does each commence at the same period in all cases.

BOTANICAL SOCIETY OF EDINBURGH.

January 11th, 1855.—Professor Balfour, President, in the Chair.

A letter was read from Dr. Senoner, Vienna, in which he remarks: —"I beg your attention to the specimens of Auer's new discovery of 'natural self-printing,' which must be of importance to the interests of botany, especially to the study of the Cryptogamics. As yet the discovery has been but little applied practically. Von Heufler has published the Cryptogamic Flora of the valleys of the Siebenburgen with illustrations of this kind. Von Ettingshausen has by this means given figures of the forms of the leaves in the Euphorbiaceæ; and there is now appearing at Trieste the Flora of Northern Italy, in drawings of this kind, of which no descriptive text has yet been published, but only the figures, with the addition of the names, the classification, and the different stations of the plants. The first fasciculus has appeared. The delineation is not so correct and clear as in Auer's self-printing, but it may be expected to be extended and improved. In Tyrol also there is coming out by Ambross a Flora of the 'Tirolo Meridionale,' which is scientifically written, and gives, in conjunction with Hausman's published Flora of Tyrol, a distinct view of the Flora of that country, which still, however, conceals many treasures."

Dr. Balfour read some observations by Mr. Quarles Harris on the Vine disease.

"The first attack," says Mr. Harris, "I conceive to have been from without, and to have fallen upon the leaves and fruit, in the form of very minute and (to the naked eye) invisible sporules of a peculiar fungus, formerly either unknown to, or not noticed by botanists, perhaps because its blasting and destructive powers were never before called into action. The Vine is thus covered with these small cryptogamic germs, which are introduced into the cells and vessels, and carried to all parts of the plant.

"The following spring, on the rising of the sap, the disease shows itself in the new shoots and in the bloom heads, and every infected vine spreads ruin around it in every direction, the spores ripening rapidly, and scattering thousands of sporules, which, wafted by every breeze, settle on the neighbouring vines.

"After the most laborious experiments and investigations, in which I have had the assistance of intelligent practical botanists and che-